*** *ALWAYS ANSWER IN FULL SENTENCES!*

*** On numerical problems, you MUST show your set ups. When dimensional analysis is specified, you MUST set up the problem by dimensional analysis.

*** Use your time wisely. Do not get stuck on one question.

*** Answer each question carefully, with thought and with confidence! Do <u>not</u> stop to check over your work until you have worked through the entire exam.

PAGE	TOTAL SCORE POSSIBLE	YOUR SCORE
1	28	
2	20	
3	18	
4	14	
5	14	
6	6	
TOTAL	100	
Bonus p.6	9	

Adjusted total to Exam II =

Current Course Total   =

LENGTH	MASS	VOLUME
1 in = 2.54 cm (exactly)	1 lb = 454 g	1 qt = 0.946 L

1 mi = 5280 ft (exactly)	1 ton = 2000 lb (exactly)	1 qt = 2 pt 1 gal = 4 qt

1. (10 pts) Give the formula or name as indicated below:
   HINT: Think carefully about which ones require Roman numerals!

Formula	NAME (Watch your spelling!)	Formula	NAME
$CuClO_2$	_____	_____	magnesium acetate
N_2Br_4	_____	_____	ammonium nitrite
Li_2S hypochlorite	_____	_____	calcium
$FeSO_3$	_____	_____	sodium perchlorate
H_3PO_4	_____	_____	hypochlorous acid

2. (9 pts) Complete the table below: ***Remember that the nuclear symbol MUST show 4 pieces of information:***

Nuclear Symbol	Charge	Atomic Number	Mass Number	Number of Neutrons	Number of Protons	Number of Electrons
$^{32}_{15}P$						
	0	50	60			
	0		32			22

3. (2 pts) Consider S^{2-}. How many protons does it have?   Ans. _____
                         How many electrons does it have?   Ans. _____

4. (2 pts) Which subatomic particles are found in the nucleus? Ans. _____

5. (5 pts) Matching: Write the appropriate LETTER (from the list on the right) on the blanks provided:

_____ Evidence that protons and neutrons are concentrated in a very small region of the atom.

_____ Two elements may combine to form different compounds

_____ Evidence that Dalton was incorrect in stating that all atoms of an element are identical.

_____ Evidence that all atoms contain the same identical, negatively charged particles.

_____ First to propose that matter is made of indivisible particles.

> *Note: Not all letters will be chosen.*
>
> A. Law of Conservation of Mass
> B. Proposal from Democritus & Leucippus
> C. Discovery of Radioactivity
> D. Chadwick's Discovery of Neutrons
> E. Thomson's Cathode Ray Tube Experiment
> F. Rutherford's Gold Foil Experiment
> G. Law of Definite Proportion
> H. Law of Multiple Proportions

6. (7 pts) A particular element has two isotopes in its natural occurring mixture. 47.8 % of the
    mixture is the isotope weighing 150.9196 amu. The other weighs 152.9209 amu.
    a) Calculate the atomic mass for this element. Show your work clearly and watch your sig. fig.
       No credit will be given if no work is shown.

                                                                Ans. _____

    b) What is the chemical symbol for this element?   Ans. _____

7. (4 pts) Calculate the formula mass of $Ba(NO_3)_2 \cdot 2H_2O$ in 4 sig. fig..   Show your work and
    remember to include units.

                                                                Ans. _____

8. (4 pts) Which term is associated with each of the following? Answer by writing beneath each
    formula, <u>one</u> of the following: f.u., molecule, or atom

    Br_2 NH_4Cl S_2Cl_4 $SnCl_2$

    _____   _____   _____   _____

9. (5 pts) What is the mass in ounces of 3.78 moles of $CaBr_2$? Show your dimensional analysis set
    up and give the answer to the correct sig. fig.

                                                                Ans. _____

10. (3 pts) The next few questions involve $Fe_2(SO_4)_3$. Calculate the molar mass of $Fe_2(SO_4)_3$ in 4 sig.
    fig. Show your work.

                                                          Ans. _____

11. (5 pts) How many moles of sulfur atoms are there in 16.8 g of $Fe_2(SO_4)_3$? Show your dimensional
    analysis set up and give the answer to the correct sig. fig.

                                                          Ans. _____

12. (5 pts) How many grams of $Fe_2(SO_4)_3$ would 6.63×10^{14} formula units of this compound weigh?
    Show your dimensional analysis set up and give the answer to the correct sig. fig.

                                                          Ans. _____

13. (5 pts) What is the percent composition of $Fe_2(SO_4)_3$? Show your work and give your answers in 4
    significant figures. **Circle** your final answers.

14. (8 pts) A hydrocarbon is composed of 88.8 % carbon and 11.2 % hydrogen.
   a) What is its empirical formula? Show your work clearly and write your final answer on the blank provided.

   Ans. _____

   b) If the molar mass of this compound is 108.2 g/mol, what is its molecular formula? Show your work clearly and write your final answer on the blank provided.

   Ans. _____

15. (2 pts) Methyl formate, sometimes used as an insecticide, has the structure shown below.

   $$H-\underset{\underset{\parallel}{}}{\overset{\overset{O}{\parallel}}{C}}-O-\underset{\underset{H}{\mid}}{\overset{\overset{H}{\mid}}{C}}-H$$
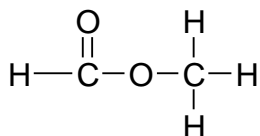
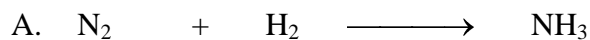   What is its empirical formula?   Ans. _____

   What is its molecular formula? Ans. _____

16. (4 pts) Define each of the following terms by completing the sentence:

   Isotopes are...

   The atomic mass unit (amu) is defined as...

17. (4 pts) Balance the equations below:

   A. N_2 + H_2 $\longrightarrow$ NH_3

   B. C_4H_{10} + O_2 $\longrightarrow$ CO_2 + H_2O
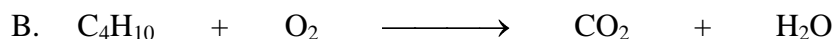
18. (4 pts) Write a **balanced** equation for the following reaction:
   When barium chloride is mixed with sulfuric acid, the products formed are barium sulfate and hydrochloric acid.

19. (2 pts) In the reaction 2 H_2 + O_2 $\longrightarrow$ 2 H_2O
   which figure below represents the **reactants**?◯ = oxygen ○ = hydrogen
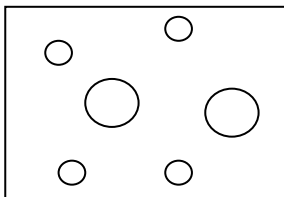
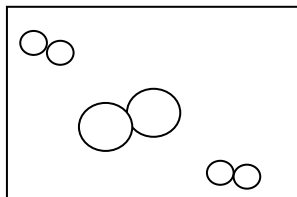   Figure A   Figure B   Figure C
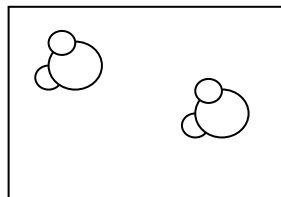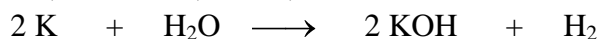
   Answer by circling one of the following:
   Figure A   Figure B   Figure C

20. (4 pts) Interpret the following reaction at the particulate level by filling in the blanks with words such as moles, molecules, atoms, formula units.
            2 K   + H_2O $\longrightarrow$ 2 KOH   + H_2

   Two potassium _____ reacted with one water _____ to produce

two _____ of potassium hydroxide and one _____ of hydrogen.

(For #21 through #26) Multiple choice (1 pt each): Circle the _**one**_ **best answer** for each question below:

21. Tl (thallium, atomic number 81) in nature consists of two isotopes, one weighing 203 amu and the other weighing 205 amu. Which isotope is more abundant in this natural occurring mixture?
    A. the isotope weighing 203 amu   B. the isotope weighing 205 amu

22. Which of the following are isotopes of each other? (Circle only ONE pair.)

    A. $^{76}_{33}As$ and $^{76}_{34}Se$ B. $^{52}_{23}X$ and $^{54}_{23}X$ C. Fe^{2+} and Fe^{3+} D. $^{93}_{41}X$ and $^{93}_{42}X$

23. How many moles of N are in 3 moles of $(NH_4)_2S$?
    A. 1 moles   B. 2 moles   C. 3 moles   D. 6 moles   E. 6.02×10^{23}

24. What kind of compound always has a formula that is the same as its empirical formula?
    A. metals   B. nonmetals   C. ionic compounds.   D. molecular compounds

25. What corresponds to 1 mole of N?
    A. 14.01 amu   B. 14.01 g   C. 6.02×10^{23} g   D. 6.02×10^{23} amu

26. Which of the following units correspond to the macroscopic level?
    A. amu   B. f.u.   C. mL   D. molecule

_____

BONUS POINTS
(1 pt) Make sure you have your full name on both sides of every page!!!

(8 pts) Give the formulas of the following ions. Be sure you include the proper charges:

acetate	_____	acetic acid	_____
carbonate	_____	carbonic acid	_____
hydroxide	_____		
phosphate	_____	phosphoric acid	_____
chlorate	_____	chloric acid	_____
ammonium	_____		
sulfate	_____	sulfuric acid	_____
nitrate	_____	nitric acid	_____